(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 595 157 A1**

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number: **93116826.4**

(51) Int. Cl.5: **D01D 5/253**

(22) Date of filing: **19.10.93**

(30) Priority: **27.10.92 US 967002**
27.10.92 US 967003

(43) Date of publication of application:
04.05.94 Bulletin 94/18

(84) Designated Contracting States:
BE CH DE FR GB IT LI NL

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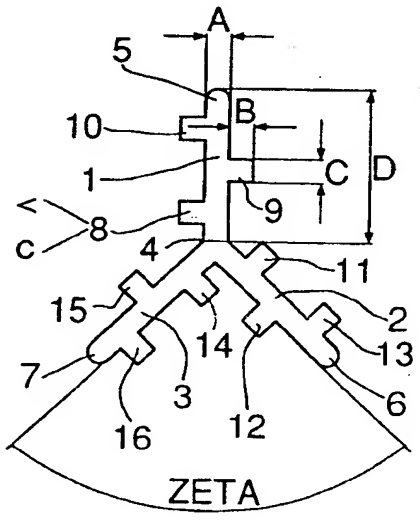
(54) **A multilobal fiber with projections on each lobe for carpet yarns and spinnerette plate for their manufacture.**

(57) Described is a synthetic fiber for use in carpets, having a multilobal cross section, each lobe of said multilobal cross section having two ends, one end being connected to the other lobes, the other end of said lobes radiating outwardly, each lobe having a plurality of projections, alternating along the contour of each lobe.

Described is a spinnerette plate for the manufacture of multilobal fibers comprising at least one opening having a plurality of lobes, each lobe having two ends, one end being connected to the other lobes, the other end of each said lobes radiating outwardly and each lobe having a plurality of projections alternating along the contour of each lobe.

FIG.2



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The capillary of the spinnerette plate of the present invention is described with reference to Fig. 2 for a trilobal opening:

Lobes (1), (2) and (3) have two ends each, (4), (5); (4), (6) and (4), (7). On one end (4) the lobes are connected to each other end. The angles between the lobes (1), (2) and (3) are from about 100° to about 140°, preferably about 120°.

The projections (8), (9), (10); (11, (12), (13); (14), (15) and (16) alternate along the contour of each lobe. The number of projections per lobe is usually in the range of from 2 to 6, preferably from 2 to 4 and particularly preferably 3.

The projections may be different in each lobe and may have different types of shapes like rectangular, square, triangular or round. Preferred is one type of shape, preferably rectangular or square shape in the spinnerette.

The tetralobal opening (capillary) in the spinnerette plate according to Fig. 3 has four lobes (33), (34), (35 and (36). On one end (37) the lobes are connected to each other, the other end of each lobe (38), (39), (40) and (41) radiating outwardly. The angles between the lobes (38), (39), (40) and (41) are from about 80° to 100°, preferably about 90°.

The projections (42), (43), (44); (45), (46), (47); (48), (49), (50) and (51), (52) and (53) alternate along the contour of each lobe. The number of projections is usually in the range of from 2 to 6, preferably of from 2 to 4 and particularly preferred 3.

The dimensions of the different parts and their relationship to each other of the capillary of the spinnerette plate of the present invention are as follows:

A is the width of the lobe
B is the width of the projection
C is the length of the projection
D is the length of the lobe

The dimensions A, B, C and D usually satisfy the following mathematic relationships:

$1.4 \leq ((1.73\ D) / A)^{1/2} \leq 49$;

preferably $6.3 \leq ((1.73\ D) / A) \leq 30.3$;

$0.5A \leq B \leq 2A$; and $0.5A \leq C \leq 2A$.

The length in mm of A and B usually satisfies the following relationship:

$0.04\ mm \leq A \leq 0.15\ mm$, preferably $0.06\ mm \leq A \leq 0.12\ mm$ and

$0.06\ mm \leq D \leq 3\ mm$, preferably $0.08\ mm \leq D \leq 2.7\ mm$.

The angle zeta between the lobes of the trilobal capillary is usually from 70° to 140°, preferably from 110 to 130°, most preferred 115 to 125°, in particular 120°.

The angle zeta between the lobes of the tetralobal capillary is usually from 70° to 140°, preferably form 80° to 100° most preferred 85 to 95°, in particular 90°.

The disclosed dimensions are dependent from for example polymer type, spinning temperature, melt viscosity of the polymer and quench medium.

The desired "modification ratio" for the resulting filaments is also an important factor. By the term "modification ratio" (MR) it is meant the ratio of the radius of a circle which circumscribes the filament cross-section to the radius of the largest circle which can be inscribed within the filament cross-section.

The two circles are shown as dotted lines in Fig. 2a and Fig. 3a. The dimensions in the capillaries of the spinnerette plate are preferably such, that the MR for the cross-section of the resulting fiber is from 1.2 to 7, preferably from 2.5 to 5.

The respective polymer is extruded through the capillary of the spinnerette plate described in Fig. 2 or Fig. 3 to form a fiber having a cross-section described in Fig. 2a or Fig. 3a.

The trilobal cross-section of the fiber according to Fig. 2a has three lobes (17), (18) and (19) with two ends each (20), (21); (20), (22); and (20), (23).

On one end (20) the lobes are connected to each other, the other end of each lobe (21), (22) and (23) radiating outwardly.

The projections (24), (25), (26); (27), (28), (29) and (30), (31), (32) alternate along the contour of each lobe. According to the shape of the projections in the spinnerette, the projections of the cross section of the fiber differ slightly.

The tetra lobal cross-section of the fiber according to Fig. 3(a) has four lobes (54), (55), (56) and (57) with two ends each (58), (59); (58), (60); (58), (61) and (58), (62).

On one end (58) the lobes are connected to each other and radiating outwardly to the other end of each lobe (59), (60), (61) and (62).

The projections (63), (64), (65); (66), (67), (68); (69), (70), (71); and (72), (73), (74) alternate along the contour of each lobe. According to the shape of the projections in the spinnerette, the projections of the

Table 1

yarns		cross-section	luster	bulk
1.	control, two-step	3.2 MR trilobal	high	medium-high
2.	control, one step	3.2 MR trilobal	high	medium
3.	Example 1	5.0 MR trilobal	low	medium-high
MR: modification ratio				

Example 2

Nylon 6 (RV = 2.7) filaments were spun using three of the modified cross-section spinnerettes using the above-described process for the main extruder and with a sidearm extruder attached to the main extruder. The sidearm extruder was fed with a nylon 6 polymer blended with color concentrates to produce yarns of red, blue and green colors.

The polymer temperature was controlled at the pumpblock at about 265 °C ± 1 ° and the spinning throughput was 55.0 g/min per spinnerette.

The filaments were drawn on a drawtwister at a draw ratio of 3:10 to a final denier of 220/12 filament and combined on an air texturing machine. A yarn with a denier of 200/35 filament was used as the core yarn and the green, red and blue yarns were used as accent yarns and textured to give a space-dye look in carpet.

The carpets were 25 oz (708.75 g) level loop and were compared to carpets made by the same process using the same blends of colors. The comparative carpets were using a trilobal cross-section yarn drawn to a final denier of 220/14 filament. Results are shown in table 2.

Table 2

yarns		cross-section	texture
1.	Control	round	fair
2.	Control	2.6 MR trilobal	good
3.	Example 2	4.6 MR trilobal	good
MR: modification ratio			

Claims

1. A synthetic fiber, having a multilobal cross section, each lobe of said multilobal cross section having one end and another end, one end being connected to an other lobe, the other end of each of said lobes radiating outwardly, each lobe having a plurality of projections, alternating along a contour of each lobe, each projection radiating outwardly from a central portion of each lobe and having no counterpart on the opposite side of said lobe at said central portion.

2. The fiber according to claim 1, wherein the dimensions of said fiber and said lobes satisfy the following mathematic relationship:
$1.2 \leq R2/R1 \leq 7.0$
$1.1\ L1 \leq L2 \leq 5\ L1$; and
$L1 \leq L2 \leq R1$;
wherein
L1 is the narrowest width of the lobe;
L2 is the widest width of the lobe;
R1 is the inner fiber diameter; and
R2 is the outer fiber diameter

FIG.1

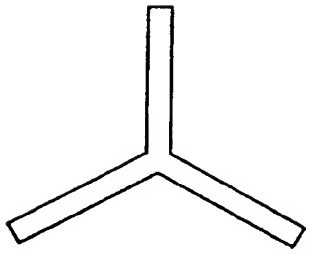


FIG.1A

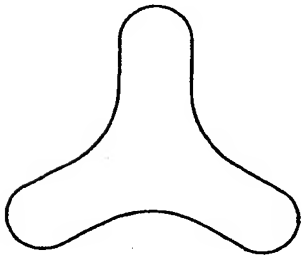
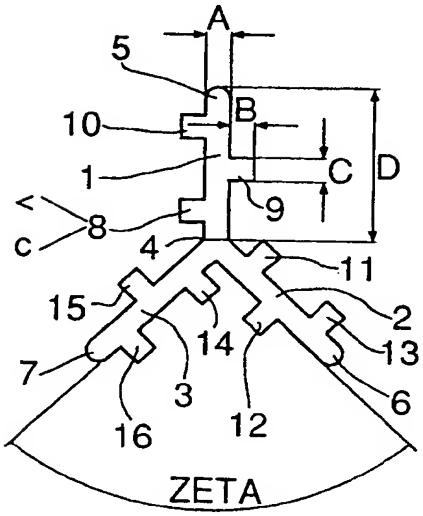


FIG.2



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EUROPEAN SEARCH REPORT

Application Number
EP 93 11 6826

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
D,A	US-A-5 108 838 (WAE-HAI TUNG)		D01D5/253
D,A	US-A-3 109 195 (JACK LEE COMBS ET AL.)		
A	US-A-3 097 416 (ALFRED H. MCKINNEY)		

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

D01D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 February 1994	Tarrida Torrell, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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